CLAIMS

What is claimed is:

1. A capacitive sensing device for use in a keypad assembly of an electronic system, said capacitive sensing device comprising:

a substantially transparent single sheet capacitive sensor, said substantially transparent single sheet capacitive sensor configured to be disposed within said keypad assembly without requiring the formation of key post holes therethrough; and

said substantially transparent single sheet capacitive sensor having a flexibility which enables desired tactile response during use of keys of said keypad assembly.

2. The capacitive sensing device of Claim 1, wherein said substantially transparent single sheet capacitive sensor comprises:

a substantially transparent substrate;

a first pattern of conductive sensors disposed above said substantially transparent substrate, said first pattern of conductive sensors comprised of a substantially transparent material and disposed within a sensing region;

a second pattern of conductive sensors disposed above said substantially transparent substrate, said second pattern of conductive sensors comprised of said substantially transparent material and disposed within said sensing region, said substantially transparent material of said first pattern of conductive sensors and said

substantially transparent material of said second pattern of conductive sensors disposed in a common single layer above said substantially transparent substrate; and

a plurality of conductive bridges disposed to electrically couple portions of said second pattern of conductive sensors.

3. The capacitive sensing device of Claim 2, wherein said plurality of conductive bridges is opaque.

4. The capacitive sensing device of Claim 2, wherein said substantially transparent material comprises indium tin oxide.

5. The capacitive sensing device of Claim 2, wherein said first pattern of conductive sensors further comprises:

at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said first pattern of conductive sensors.

6. The capacitive sensing device of Claim 5, wherein said portion of said substantially opaque conductive material further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

7. The capacitive sensing device of Claim 5, wherein said first pattern of conductive sensors is disposed to minimize capacitive interference with at least one of said plurality of conductive bridges.

8. The capacitive sensing device of Claim 5, wherein said portion of said substantially opaque conductive material overlies at least a portion of said substantially transparent material of said first pattern of conductive sensors.

9. The capacitive sensing device of Claim 5, wherein said substantially opaque conductive material comprises conductive ink.

10. The capacitive sensing device of Claim 2, wherein said second pattern of conductive sensors further comprises:

at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said second pattern of conductive sensors.

11. The capacitive sensing device of Claim 10, wherein said portion of said substantially opaque conductive material overlies at least a portion of said substantially transparent material of said second pattern of conductive sensors.

12. The capacitive sensing device of Claim 10, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors

further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

13. The capacitive sensing device of Claim 2, wherein said plurality of conductive bridges is selectively disposed to lessen visual interference with indicia of said keys of said keypad assembly.

14. A capacitive sensing device comprising:

a substantially transparent substrate;

a first pattern of conductive sensors disposed above said substantially transparent substrate, said first pattern of conductive sensors comprised of a substantially transparent material, said first pattern of conductive sensors disposed within a sensing region;

a second pattern of conductive sensors disposed above said substantially transparent substrate, said second pattern of conductive sensors comprised of said substantially transparent material, said second pattern of conductive sensors formed within said sensing region, said substantially transparent material of said first pattern of conductive sensors and said substantially transparent material of said second pattern of conductive sensors disposed in a common single layer above said substantially transparent substrate; and

a plurality of conductive bridges disposed to electrically couple portions of said second pattern of conductive sensors.

15. The capacitive sensing device of Claim 14, wherein said plurality of conductive bridges is opaque.

16. The capacitive sensing device of Claim 14, wherein said first pattern of conductive sensors further comprises:

at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said first pattern of conductive sensors.

17. The capacitive sensing device of Claim 16, wherein said portion of said substantially opaque conductive material further comprises openings extending therethrough to allow light to pass through said openings of said substantially opaque conductive material.

18. The capacitive sensing device of Claim 16, wherein said first pattern of conductive sensors is disposed to minimize capacitive interference with at least one of said plurality of conductive bridges.

19. The capacitive sensing device of Claim 16, wherein said portion of said substantially opaque conductive material overlies at least a portion of said substantially transparent material of said first pattern of conductive sensors.

20. The capacitive sensing device of Claim 16, wherein said substantially opaque conductive material comprises conductive ink.

21. The capacitive sensing device of Claim 14, wherein said substantially transparent material comprises indium tin oxide.

22. The capacitive sensing device of Claim 14, wherein said second pattern of conductive sensors further comprises:

at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said second pattern of conductive sensors.

23. The capacitive sensing device of Claim 22, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors overlies at least a portion of said substantially transparent material of said second pattern of conductive sensors.

24. The capacitive sensing device of Claim 22, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

25. The capacitive sensing device of Claim 14, wherein said plurality of conductive bridges is selectively disposed to lessen visual interference with indicia of keys of a keypad assembly.

26. The capacitive sensing device of Claim 14, wherein said capacitive sensing device has a flexibility which enables desired tactile response during use of keys of a keypad when said capacitive sensing device is disposed in a keypad assembly.

27. A capacitive sensing device comprising:

a substantially transparent substrate;

a first pattern of conductive sensors disposed above said substantially transparent substrate, said first pattern of conductive sensors comprised of a substantially transparent material and disposed within a sensing region of said capacitive sensing device;

a second pattern of conductive sensors disposed above said substantially transparent substrate, said second pattern of conductive sensors comprised of said substantially transparent material and disposed within said sensing region, said substantially transparent material of said first pattern of conductive sensors and said substantially transparent material of said second pattern of conductive sensors disposed in a common single layer above said substantially transparent substrate; and

a plurality of conductive bridges disposed to electrically couple portions of said second pattern of conductive sensors,

wherein said first pattern of conductive sensors further comprises at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said first pattern of conductive sensors.

28. The capacitive sensing device of Claim 27, wherein said plurality of conductive bridges is opaque.

29. The capacitive sensing device of Claim 27, wherein said portion of said substantially opaque conductive material further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

30. The capacitive sensing device of Claim 27, wherein said first pattern of conductive sensors is disposed to minimize capacitive interference with at least one of said plurality of conductive bridges.

31. The capacitive sensing device of Claim 27, wherein said portion of said substantially opaque conductive material overlies at least a portion of said substantially transparent material of said first pattern of conductive sensors.

32. The capacitive sensing device of Claim 27, wherein said second pattern of conductive sensors further comprises:

at least a portion comprised of said substantially opaque conductive material electrically coupled to said substantially transparent material of said second pattern of conductive sensors.

33. The capacitive sensing device of Claim 32, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors overlies at least a portion of said substantially transparent material of said second pattern of conductive sensors.

34. The capacitive sensing device of Claim 32, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

35. The capacitive sensing device of Claim 27, wherein said substantially transparent material comprises indium tin oxide.

36. The capacitive sensing device of Claim 27, wherein said substantially opaque conductive material comprises conductive ink.

37. The capacitive sensing device of Claim 27, wherein said plurality of conductive bridges is selectively disposed to lessen visual interference with indicia of

keys of a keypad, when said capacitive sensing device is disposed in a keypad assembly.

38. The capacitive sensing device of Claim 27, wherein said capacitive sensing device has a flexibility which enables desired tactile response during use of keys of a keypad when said capacitive sensing device is disposed in a keypad assembly.

39. An integrated keypad assembly for an electronic device comprising:

a keypad structure;

a keymat that is deformable to actuate a switch sensor; and

a capacitive sensor coupled to said keymat and said key pad structure and not disposed beneath said keymat.

40. The integrated keypad assembly of Claim 39, wherein said capacitive sensor comprises sensors having at least a portion thereof disposed around an area to be lighted.

41. The integrated keypad assembly of Claim 39, wherein said capacitive sensor is disposed between said keymat and said key pad structure.

42. The integrated keypad assembly of Claim 39, wherein said keypad structure is integral with said keymat.

43. The integrated keypad assembly of Claim 39, wherein said capacitive sensor is integrated within said keymat.

44. The integrated keypad assembly of Claim 39, wherein said capacitive sensor comprises a single sheet capacitive sensor.

45. The integrated keypad assembly of Claim 44, wherein said single sheet capacitive sensor comprises:

a substantially transparent substrate;

a first pattern of conductive sensors disposed above said substantially transparent substrate, said first pattern of conductive sensors comprised of a substantially transparent material and disposed within a sensing region of said capacitive sensor;

a second pattern of conductive sensors disposed above said substantially transparent substrate, said second pattern of conductive sensors comprised of said substantially transparent material and disposed within said sensing region, said substantially transparent material of said first pattern of conductive sensors and said substantially transparent material of said second pattern of conductive sensors disposed in a common single layer above said substantially transparent substrate; and

a plurality of conductive bridges disposed to electrically couple portions of said second pattern of conductive sensors.

46. The integrated keypad assembly of Claim 45, wherein said plurality of conductive bridges is opaque.

47. The integrated keypad assembly of Claim 45, wherein said first pattern of conductive sensors further comprises:

at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said first pattern of conductive sensors.

48. The integrated keypad assembly of Claim 47, wherein said portion of said substantially opaque conductive material further comprises openings extending therethrough such that light is able to pass therethrough.

49. The integrated keypad assembly of Claim 47, wherein said first pattern of conductive sensors is disposed to minimize capacitive interference with at least one of said plurality of conductive bridges.

50. The integrated keypad assembly of Claim 47, wherein said portion of said substantially opaque conductive material overlies at least a portion of said substantially transparent material of said first pattern of conductive sensors.

51. The integrated keypad assembly of Claim 47, wherein said portion of said substantially opaque conductive material comprises conductive ink.

52. The integrated keypad assembly of Claim 45, wherein said second pattern of conductive sensors further comprises:

at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said second pattern of conductive sensors.

53. The integrated keypad assembly of Claim 52, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors overlies at least a portion of said substantially transparent material of said second pattern of conductive sensors.

54. The integrated keypad assembly of Claim 52, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

55. The integrated keypad assembly of Claim 45, wherein said substantially transparent material comprises indium tin oxide.

56. The integrated keypad assembly of Claim 45, wherein said plurality of conductive bridges is selectively disposed to minimize visual interference with indicia of keys of said key pad structure.

57. The integrated keypad assembly of Claim 45, wherein said single sheet capacitive sensor has a flexibility which enables desired tactile response during use of keys of said key pad structure when said single sheet capacitive sensor is disposed in said keypad assembly.

58. A method of forming a capacitive sensing device, said method comprising:

disposing a first pattern of conductive sensors above said substantially transparent substrate within a sensing region, said first pattern of conductive sensors comprised of a substantially transparent material;

disposing a second pattern of conductive sensors above said substantially transparent substrate within said sensing region, said second pattern of conductive sensors comprised of said substantially transparent material, said substantially transparent material of said first pattern of conductive sensors and said substantially transparent material of said second pattern of conductive sensors disposed in a common single layer above said substantially transparent substrate; and

disposing a plurality of conductive bridges to electrically couple portions of said second pattern of conductive sensors.

59. The method as described in Claim 58, wherein said plurality of conductive bridges is formed of opaque material.

60. The method as described in Claim 58, wherein disposing said first pattern of conductive sensors further comprises:

disposing at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said first pattern of conductive sensors.

61. The method as described in Claim 60, wherein said portion of said substantially opaque conductive material further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

62. The method as described in Claim 60, wherein said first pattern of conductive sensors is disposed to minimize capacitive interference with at least one of said plurality of conductive bridges.

63. The method as described in Claim 60, wherein said portion of said substantially opaque conductive material overlies at least a portion of said substantially transparent material of said first pattern of conductive sensors.

64. The method as described in Claim 60, wherein disposing said second pattern of conductive sensors further comprises:

disposing at least a portion comprised of a substantially opaque conductive material electrically coupled to said substantially transparent material of said second pattern of conductive sensors.

65. The method as described in Claim 64, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors further comprises openings extending therethrough such that light is able to pass through said openings of said substantially opaque conductive material.

66. The method as described in Claim 64, wherein said portion of said substantially opaque conductive material of said second pattern of conductive sensors overlies at least a portion of said substantially transparent material of said second pattern of conductive sensors.

67. The method as described in Claim 58, wherein said substantially transparent material is formed of indium tin oxide.

68. The method as described in Claim 58, wherein said plurality of conductive bridges is selectively disposed to lessen visual interference with indicia of keys of a keypad assembly.